# Kootenay Lake Forest Districts

## Inventory Plan

MINISTRY OF FORESTS
RESOURCES INVENTORY BRANCH
JULY 2, 1998

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# 1. INTRODUCTION

## 1.1 Background

The Provincial Vegetation Resources Inventory (VRI) or Provincial Inventory is an improved vegetation (forest) inventory process or toolbox for assessing the quantity and quality of British Columbia's timber and other vegetation resources. It addresses the concerns expressed by the Forest Resources Commission in its 1991 report, *The Future of our Forests*. These concerns included:

- lack of statements of precision of the inventory;
- inadequate information on non-timber vegetation resources;
- lack of reliable estimates of growth rates and stand specific volumes; and
- narrow focus on commercial timber volume and the timber harvesting landbase.

The VRI can be implemented at a number of levels depending on the business needs. It can be deployed over the entire province (one or more Forest District at a time), measuring all the timber and non-timber resources. The VRI can also be deployed over a Management Unit (TFL or TSA) or a small watershed within a District, measuring selected resources in specific portions of the landbase.

The Provincial Inventory consists of a system of protocols, models and databases that can be managed through a dispersed computing environment. The Provincial Inventory process can be used to meet today's needs for timber supply, long term planning, silviculture planning, defining sustainability, public information and credibility. The Provincial Inventory can also provide data for computer modeling and decision support systems to support a baseline biodiversity assessment and for research.

The Vegetation Resources Inventory is designed to determine:

- the amount of vegetation cover in the province;
- the location of vegetation resources in the province; and
- the changes in the amount and location of vegetation resource over time.

The principles guiding the implementation of the inventory are:

- to integrate provincial inventory activities (e.g. Management Inventories, Provincial Inventory, National Forest Inventory and Monitoring);
- to implement inventory projects to satisfy business requirements as defined in the inventory plans; and
- to maximize the usefulness of sample plots and minimize overall costs by implementing a cascading plot approach that ensures that information collection meets the VRI standards while meeting multiple goals.

Management Inventories include inventories conducted in Implementation Units[1], to fulfill specific forest management or business needs. Sampling error and sampling intensity are controlled for specific vegetation attributes (e.g., timber volume) to achieve specific inventory objectives. There are several types of Implementation Units in the province: Timber Supply Areas (TSAs), Tree Farm Licenses (TFLs), and other lands (parks, private lands, and other public lands). Within (or across) these Implementation Units there may be Management Inventories addressing specific issues such as Problem Forest Types, or other strata in a TSA (or groups of TSAs).

Management Inventories are typically timber emphasis inventories. Besides providing detailed polygon information for day-to-day forest management, they can also be used to increase precision of the Provincial Inventory. The TFL holders or the MoF Regions/Districts are responsible for the planning and implementation of these inventories. However, the Ministry of Forests Resources Inventory Branch requires the TFL holder(s), stakeholder(s), or District(s) to prepare an inventory business plan, which includes a sampling plan, for its approval. An inventory business plan defines the inventory needs, the information needed to meet the needs, and the methods for collecting the information. This business plan then drives the inventory project plans.

## 1.2 Objectives

This is a plan for implementing the Provincial and Management Inventory activities in the Kootenay Lake Forest District in the Nelson Forest Region. This plan was developed through consultation with various stakeholders during September 1997 including staff from the Ministry of Forests (MOF) (Resources Inventory Branch, Nelson Forest Region, and Kootenay Lake Forest District), Ministry of the Environment, Lands, and Parks, Kootenay Lake Forest Association, and BC Parks. Management issues identified in the recent Timber Supply Review in the TSA were also reviewed.

The purpose of the Inventory Plan is to:

1. define the Management Inventory objectives;
2. define a Provincial Inventory strategy for Kootenay Lake Forest District;
3. identify the inventory activities required to satisfy the objectives for both inventories; and
4. outline the implementation steps.

This plan is based on the consultant report, *Kootenay Lake Forest District Vegetation Resources Inventory Ground Sampling Plan, Revised Final Report,* prepared by J.S. Thrower & Associates. The report was prepared following the procedures outlined in the Ministry of Forests, Resources Inventory Branch procedures *Vegetation Resources Inventory: Preparing a sampling plan for ground sampling* (March 1997). The report has

[1] Implementation Units are a specified area of land such as a TSA, TFL, Innovative Forest Practices Agreement area, etc. For any Implementation Unit, there can be none to several Management Inventories based on stakeholder business needs.

been reviewed by stakeholders in the District and is attached to this Inventory Plan (see Appendix A).

This Inventory Plan identifies stakeholder requirements at a given point in time. As such, it is anticipated that there will be changes to this plan. Any changes including plans that are more detailed and roles and responsibilities will be added to this plan as an addendum.

# 2. BUSINESS CONSIDERATIONS

## 2.1 Forest Management Issues

Forest management issues were identified during the recent timber supply review (Table 1). An assessment of potential impacts of the VRI ground sampling on these management issues is also shown in these tables.

Table 1. Forest management issues for the Kootenay Lake Forest District and the potential impact on the Provincial Inventory.

| | Issue[2] | Impact | Remarks |
|---|---|---|---|
| 1. | Watershed guidelines: incorporate into next analysis. | No | Application of the Inventory |
| 2. | Inventory audit. | Partial | The inventory audit has been completed.[3] The results suggest that overall the mature volumes in the TSA are accurate. Phase II plots will help check these inventory audit conclusions. |
| 3. | Growth & yield: evaluate the discrepancy between actual harvested volume and projected volumes. | No | Application of the Inventory |
| 4. | Root rot, regenerated stands: review OAFs, and examine impact to green-up period and volumes. | Partial | Phase II plots will indicate incidence and severity of root rot in the District for more intensive sampling or research. |
| 5. | Site productivity: assess results of the paired plot study and examine impact on green-up period (OGSI). | Partial | Site index measurements from Phase II plots can be used to help check the site index estimates in the current inventory database, and to develop correlations with other attributes. However, these data will not address the issue of potential site index and productivity of stands. As well, they will not correct for inappropriate site curves. |
| 6. | Incorporate slope and terrain stability mapping into next analysis. | No | Application of the Inventory |
| 7. | Commercial thinning: assess benefits. | No | Phase II will not help assess the benefits of commercial thinning. Phase II provides volume estimates but not enough information as to whether or not to commercially thin. |

[2] BC Ministry of Forests. Timber Supply Branch. 1996. Forest Management Issues Identified Through the AAC Determination Process. TSA/TFL Timber Supply Reviews: 1992-1996. 31 December 1996. Victoria BC. Pages 98-102.

[3] BC Ministry of Forests. Resources Inventory Branch. (no date). Kootenay Lake TSA Inventory Audit.

| | Issue[2] | Impact | Remarks |
|---|---|---|---|
| 8. | Regenerated stands: review managed stand yield tables. | No | Application of the Inventory |
| 9. | Utilization standards: regional change would be reflected in AAC analysis. | No | Application of the Inventory |
| 10. | Harvest profile: ensure operations are well distributed across the landbase. | No | Application of the Inventory |
| 11. | Harvest uneconomic drainages: review carefully prior to next analysis. | No | Application of the Inventory |
| 12. | Low site quality sites: consider inclusion of low sites if bona fide proposals to utilize them come forward. | Partial | Phase II could check volumes, piece size, and site index through sub-unit inventories. |
| 13. | Potential increase: consider where increase may occur. | Partial | Application of the Inventory |
| 14. | Timber agreement land: review assumptions regarding the reversion schedule in analysis. | No | Application of the Inventory |
| 15. | Brushing: consider positive effect on green-up, regeneration delay, and height growth. | No | Application of the Inventory |
| 16. | Partial cutting: evaluate effects on VQOs on innovations in harvesting. | No | Application of the Inventory |
| 17. | Incremental, fertilization, and commercial thinning: evaluate. | No | Application of the Inventory |
| 18. | Decrease of available timber: analyze and project effects of LRUPs in future analysis. | Partial | Application of the Inventory |
| 19. | Sensitive soils, operable areas: review. | No | Application of the Inventory |
| 20. | Forest Ecosystem Networks (FENs): assess impacts. | Partial | Application of the Inventory |

## 2.2 Inventory Issues

The most recent Timber Supply Review identified specific issues and information needed to improve the inventory. These are related to the management issues in Table 1 and include:

- Check timber inventory in the rest of the landbase estimates (beyond mature stands).
- Root rot – examine incidence and severity.
- Excluded forest types – low volume and site index.
- Site index estimates in immature stands – may be inaccurate.
- Improve timber harvesting landbase (THLB) inventory for timber supply review.
- Individual polygon descriptions were found to be poor (according to the PIA).
- Monitoring issues of taper equation, decay and waste, standard inventory, and projections.

- Classification of young stands (age class 1, 2, 3) by species, composition, age, and height.
- PIA recommends the emphasis of age class 3, 4, 5.
- Private land inventory status is unknown (Darkwoods Forestry Ltd.).
- Goat Range, Kokanee, and Purcell Parks all straddle District boundaries; BC Parks may decide to sample the entire parks individually in sub-unit inventories, however, that is a business decision to be made by BC Parks.
- Provincial and TSA monitoring of the indicators of sustainable forest management, as defined by the Canadian Council of Forest Ministers (CCFM).[4] Monitoring would involve measuring changes and trends in some of these indicators, which include percent and extent of area by forest type and age class, and mean annual increment by forest type and age class.
- Issues raised by the Forest Resources Commission's 1991 report, *The Future of Our Forests*, regarding the inadequacy of forest inventories in the province. These concerns included lack of statements of precision on the inventory, inadequate information on non-timber vegetation, and the narrow focus on commercial timber volume and the operable landbase.

# 3. INVENTORY PLAN

## 3.1 Provincial Inventory

### 3.1.1 Provincial Inventory Landbase

The planned inventory unit for the Kootenay Lake VRI is the Kootenay Lake Forest District. The Kootenay Lake Forest District total area is approximately 1.4 million ha and includes the Timber Supply Area (TSA), Parks and Conservancy areas, and private land. The TSA is the major management unit, which is approximately 1.1 million ha, of which 26.3% is the timber harvesting landbase.

### 3.1.2 Objectives

#### *3.1.2.1 Photo Interpretation*

There appears a need to improve attribute accuracy of the inventory at the individual polygon level. However, before a decision to do a new Phase I is made, new estimates should be derived for the sample polygons (135) in which Phase II samples are installed. This should be done using one photo interpreter to provide consistency among estimates.

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[4] Canadian Council of Forest Ministers. 1995. *Defining Sustainable Forest Management. A Canadian Approach to Criteria and Indicators.* Natural Resources Canada, Canadian Forest Service. Ottawa, ON. 22pp.

Existing polygon boundaries would be maintained, and the additional data would be used to evaluate potential benefits of new Phase I estimates. This photo typing may be done before or after the VRI ground sampling.

#### *3.1.2.2 Ground Sampling*

The objective of the District VRI ground sampling is to provide overall totals and averages for timber and non-timber vegetation resources (medicinal plants and other botanical forest products) in the Kootenay Lake Forest District. The number of ground samples should aim to achieve a sampling error of ±10% (95% probability) for timber volume in the District, and allow for calculation of sampling errors for other VRI attributes. The key attributes of interest in the Kootenay Lake VRI are timber volume and site index. While information will be collected on all attributes, the variability of identified key attributes will be used to set the sample size for the VRI.

The VRI will cover the entire District and will include the timber harvesting landbase, the non-timber harvesting landbase, Parks, Conservancy areas, and private lands

### 3.1.3 Sampling Plan

#### *3.1.3.1 Sample Size*

To achieve the inventory objectives as identified above, the sample size required to implement the Provincial Inventory are summarized in Table 2. In inventory, a sampling error standard is necessary to provide a basis for determining sample size. In the VRI, the allowable sampling error standard is set at ±10% for volume estimation at the Unit/District level. This standard does not apply to the other attributes in the inventory.

The number of samples required to achieve the standard is a function of the variation within the inventory unit, estimated by the coefficient of variation (CV%). The estimated CV in the Kootenay Lake Forest District used to estimate the total number of plots to achieve a sampling error of ±10% for net volume is 51%[5]. To achieve the Provincial Inventory standard at a reasonable cost, two types of VRI plots will be used:

- full VRI samples, where the full suite of information (timber, coarse woody debris, range and ecology) is collected; and
- tree emphasis samples, where only tree information is collected.

The total number of full VRI samples (50) will be adequate to achieve a sampling error of ±15% in the treed landbase. Tree emphasis samples (TEP) (55) will then be used to reduce the sampling error in the treed landbase to ±10% to achieve the standard.

In the remaining non treed area of the unit, the number of full VRI samples established (30) will be the ratio of the treed to remaining landbase, multiplied by the number of treed VRI samples required to achieve a sampling error of ±15%.

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[5] The inventory audit CV was inflated by 25% to account for the possible differences between the CV estimates based on the VRI design (a tight 5-plot cluster) and based on the inventory audit (a well-distributed 9-plot cluster).

Implementing the two types of samples will ensure a minimum number of full VRI plots are established across the landscape to collect the full suite of VRI information. Establishing TEPs to increase the number of plots required to achieve the VRI standard will result in saved time and money.

To complete the Provincial Inventory, NVAF (net volume adjustment factor) and WPV (within polygon variation) sampling is required. The numbers of these types of samples are contained in Table 2.

Table 2. The estimated sample size required to implement the Provincial Inventory.

| Ground Sampling Activity | Sampling Unit | VRI Samples | Tree Emphasis Samples | Sample Size |
|---|---|---|---|---|
| Provincial Inventory | | | | |
| Vegetated Treed | Cluster | 50 | 55 | 105 |
| Other | Cluster | 30 | - | 30 |
| Net Volume Adjustment Factor | Tree | 75 | | 75 |
| Within Polygon Variation | Polygon | 30 | | 30 |

### *3.1.3.2 Provincial Inventory Sampling*

To achieve the Provincial Inventory objective, the sampling should be implemented in a two-step process. Step 1 is to install approximately 80 sample clusters in the first field season over the entire District. Step 2 is to install the remaining sample clusters in the second field season. The sampling locations will be selected systematically from the sorted list of potential sampling points. This list will include all polygons in the District and will be sorted by non-vegetated/vegetated and then land type, leading tree species, age, and site index. Sampling in the first year will provide experience to refine the process for the second field season, and information to calculate precisely the remaining number of samples required to meet the precision target of ±10% for total net volume in the treed portion of the District. An estimated total of 200 sample clusters will be assumed for planning, training, and other logistic considerations. Matching unavailable sampling sites with sub-sampling of sample clusters with difficult access will be anticipated and planned for, as these activities will increase inventory costs.

A two-step approach should also be used for implementing the other ground sampling activities that support the Provincial Inventory process: NVAF sampling and WPV sampling. NVAF provides a factor to adjust the net volume from the ground sampling (derived from the net factoring process and taper equations) to account for hidden decay and possible bias in taper equations. WPV information is used to express the total error of the inventory and to indicate accuracy of individual polygon estimates. A total of 75 sample trees for NVAF sampling (selected from 15 treed and 1 non-treed polygons) and 30 sample polygons for WPV sampling are required.

## 3.2 Management Inventory

### 3.2.1 Management Unit Landbase

For the Kootenay Lake Forest District, four Management Units were created to address the inventory issues raised by the stakeholders. These sub-units correspond to:

1. all polygons in the TSA, including the Parks and private land, to improve the timber inventory (volume, height, and age) in the timber harvesting landbase (THLB).
2. immature (age class 1-5) stands, to improve the timber inventory (site index, volume, height, age, and species composition).
3. "excluded" forest types in the District, to confirm and estimate their volumes.
4. improving individual polygon descriptions.

Table 3 provides an approximation of the area to be assessed by the Provincial Inventory and the Management Inventories.

Table 3. Area by Inventory Unit within the Kootenay Lake Forest District.

| Inventory Type | Inventory Unit | Area (ha) |
|---|---|---|
| Provincial | Kootenay Lake Forest District | 1,389,150 |
| Management | Timber harvesting landbase | Not Available |
| | Timber harvesting landbase | Not Available |
| | "excluded" forest types | Not Available |
| | Polygon descriptions | Not available |

### 3.2.2 Objectives

#### *3.2.2.1 Photo Interpretation*

See Section 3.1.2.1.

#### *3.2.2.2 Ground Sampling*

The ground sampling objectives for the Management Inventories are to:

- **Timber harvesting landbase**: to improve the accuracy of timber net volume and site index in the timber harvesting landbase (THLB) of the Kootenay Lake TSA. This objective addresses the timber volume and site productivity issues in preparation for the next timber supply review. The sampling should aim to achieve a sampling error of ±10% (95% probability) for net timber volume in the THLB of the TSA.
- **Immature**: to improve the timber inventory (site index, volume, height, age, and species composition) in the immature stands (age class 1-5) in the TSA.
- **"excluded" forest types**: to improve the timber inventory (site index, volume, height, age, and species composition) in the immature stands (age class 1-5) in the TSA.
- **Polygon descriptions**: to improve the timber inventory (site index, volume, height, age, and species composition) in the immature stands (age class 1-5) in the TSA.

### 3.2.3 Sampling Plan

To achieve the objectives of the Management Inventories, Timber Emphasis Sampling will be required. The Timber Emphasis Sampling must meet the minimum sampling requirements as specified in *Implementation Strategy to Integrate Management, Provincial and National Inventories* (MoF, Resources Inventory Branch) The supplemental sampling will involve the installation of approximately:

- 100 sample clusters in the Timber Harvesting Land Base. This includes 20 samples that overlap with the Provincial Inventory;
- 100 sample clusters in the immature;
- 100 sample clusters in the "excluded" forest types; and
- To improve polygon descriptions, prior to any ground sampling it should be confirmed that this sub-unit inventory is necessary after the data from the VRI ground sampling photo-typing are analyzed.

The implementation should proceed in a manner similar to the Provincial Inventory ground sampling. The sampling will be spread over a period of 2 years, with unbiased interim results expected after the first season. Sampling in the first year will provide experience to refine the process for the second field season and information to calculate precisely the remaining number of samples required to meet the precision target of ±10%.

NVAF sampling is not required for Management Inventories however it is strongly encouraged. Stakeholders should identify within their more detailed *Inventory Plans*[6] if NVAF sampling is to be conducted.

# 4. IMPLEMENTATION STRATEGY

The ground samples that are established to meet the Management Inventory objectives are compatible with the Provincial Inventory objectives providing that these dual-purpose plots are identified prior to establishment. Therefore, Provincial Inventory plots will be identified prior to identifying the Management Inventory ground sampling plots. These coincident plots will be used for both the Provincial Inventory and the Management Inventory. Additional Management Inventory samples will be established to meet Management Inventory objectives. This integrated approach, that uses one set of samples to address multiple inventory needs, will result in minimum implementation costs.

There may be a need to enhance the coincident plots for non-timber attributes within the Management Inventories depending on the implementation strategy chosen. Additional Provincial Inventory ground samples will need to be established in the non-Management Inventory area in order to complete the Provincial Inventory for the Kootenay Lake Forest District.

The inventory outlined above will be completed to the Ministry of Forests minimum standards as outlined in *Implementation Strategy to Integrate Management, Provincial and National Inventories*.

## 4.1 Steps

There are several ways to complete the ground sampling in the two-step process stated above. It is hoped that stakeholders will complete all the required ground sampling in a timely manner. One possible scenario is as follows:

1. Install a large number of each Management Inventory sample clusters (e.g., 100) over the entire landbase measuring *only those* tree attributes related to timber volume and site index. Install the Provincial Inventory samples for plots that are designated "multi-purpose" and install tree emphasis plots for the others. This will provide the experience to refine the process for the second field season and will provide information to calculate the required number of remaining sample clusters.
2. Install the remaining Management Inventory sample clusters in the second field season. (Note: the stakeholder may choose to install all ground samples in one field season).

[6] Inventory Plans are required by stakeholders in order to proceed with their Management Inventories.

### 4.1.2 Implementation Process

The implementation process will proceed based on available funding and can be implemented based on a number of scenarios. All implementation scenarios will a common process. One possible implementation process could proceed as follows:

1. Assemble all polygons within the District into one list; check to ensure no areas are missing or double counted.
2. Sort the polygon list according to the criteria: BC Land Cover Classification code, estimated leading tree species, age, and site index.
3. Select potential sampling points from the sorted list, as described in the Ministry of Forests, Resources Inventory Branch document *Vegetation Resources Inventory: Preparing a sampling plan for ground sampling.*
4. Stratify list to *vegetated treed* and *remaining area* (non-vegetated, vegetated non-treed).
5. Systematically select the Provincial Inventory samples by stratum.
6. Systematically select the polygons for the WPV sampling from the list of Provincial Inventory samples.
7. Systematically select the 16 NVAF sample points (15 treed and 1 non-treed whether or not volume is indicated) from the Provincial Inventory ground samples.
8. Stratify the District to determine the Provincial Inventory samples that meet Management Inventory objectives. Subtract this number of samples from the total required for each Management Inventory. Select the remaining number of Management Inventory samples.
9. For each Management Inventory, systematically select a batch of sampling points from the list of operable sampling points (80% of the sample size) and from the list of inoperable sampling points (20%).
10. Begin planning for field sampling.
11. Prepare a field sampling plan that includes sample cluster batches to ensure an unbiased sample is attained at the end of the first field season. Identify NVAF sample points and ensure they are field sampled early in the field season.
12. Locate and measure ground sample clusters.
13. Monitor quality assurance of field data and procedures during field sampling. Arrange for 'audit quality cruisers' to sample auxiliary plots of NVAF samples.
14. Compile the data in the fall and winter of the first year. This will include computing averages of timber volume, basal area, and regression of photo estimated volume to ground sample volume and the associated standard error of the regression.
15. Prepare NVAF tree sampling matrix. Begin NVAF destructive sampling.

16. Prepare for the second step during the winter. This will include calculation of the CV based on the standard error of the regression. The remaining number of samples required to achieve the stated desired precision can then be accurately determined using standard procedures (see Appendix B).
17. Prepare the remaining samples.
18. Locate and measure remaining ground sample clusters in the second field season. Complete stem analysis of the NVAF sample trees. Complete the within polygon variation sampling.
19. Compile all data, do the statistical adjustments and load final inventory results into the provincial database.

## 4.2 Cost

### 4.2.1 Provincial Inventory

The Provincial Inventory costs, for planning purposes, are summarized in Table 4.

A CV of 51% and the objective precision level of ±10% sampling error (at the 95% probability level) were used to estimate the required number of Provincial Inventory samples.

Sampling efficiency and cost effectiveness will be achieved by implementing the Management Inventory sampling in combination with Provincial Inventory ground sampling. Results of the VRI ground sampling can be evaluated to determine the additional sampling required for meeting the specific objectives.

Table 4. The estimated costs required to complete the Provincial Inventory sample plan.

| Ground Sampling Unit | Sample size | Unit Cost* ($) | Total Cost ($) |
|---|---|---|---|
| Provincial Inventory | | | |
| Sample Cluster (VRI) | 80 | 2,500 | 200,000 |
| Sample Cluster (tree only) | 55 | 1,500 | 82,500 |
| Net Volume Adjustment Factor – Tree | 75 | 500 | 37,500 |
| Within Polygon Variation | 30 | 1,500 | 45,000 |
| Total | | | 365,000 |

* The unit costs are based on experience gained from the Boston Bar Operational Trial.

### 4.2.2 Management Inventory

The costs for completing the Management Inventory plan are identified in Table 5.

Table 5. The estimated costs required to complete the Management Inventory sample plan.

| Ground Sampling Unit | Sample size | Unit Cost ($) | Total Cost ($) |
|---|---|---|---|
| Management Inventory Sampling | | | |
| Timber Harvesting Landbase | 100 | 1,500 | 150,000 |
| Immature | 100 | 1,500 | 150,000 |
| "Excluded" Forest Types | 100 | 1,500 | 150,000 |
| Polygon Description | NA | 1,500 | NA |
| Total | 300 | 1,500 | 450,000 |

The sample size determination for the Management Inventory sampling can be found in the consultant report, *Kootenay Lake Forest District Vegetation Resources Inventory Ground Sampling Plan, Revised Final Report* (Appendix A). The required number of Management Inventory samples is based on the appropriate CV (estimated) and the objective precision level of ±10% sampling error (at the 95% probability level).

### 4.2.3 Combined Management Inventory and Provincial Inventory

Implemented separately, the total cost of the Provincial Inventory and the Management Inventories would be approximately $815,000. Combining the inventory objectives through a common implementation strategy will realize a saving. Given the multiple Management Inventories within the Kootenay Lake Forest District and their overlapping areas, it is difficult to estimate the magnitude of these savings. However, the savings on the Provincial Inventory samples would be approximately $82,500 based on implementing all of the vegetated treed VRI and tree emphasis samples in combination with the Management Inventory plots.

Table 6 illustrates the cost for one possible implementation scenario where overlap occurs between one of the Management and the Provincial Inventory. The total cost could be higher or lower if the assumptions stated above are not valid. For example, an increase in the CV or a reduction in the desired precision level will result in an increase in the number of samples required to achieve the objectives. The relationship between the sampling error and sample size is illustrated in the contractor report (Appendix A).

Table 6. Combined costs to complete the Management and Provincial Inventory sample plans.

| Ground Sampling Unit | Sample size | Unit Cost ($) | Total Cost ($) |
|---|---|---|---|
| Management Inventory Sampling | | | |
| Timber Harvesting Landbase | 100 | 1,500 | 150,000 |
| Immature | 100 | 1,500 | 150,000 |
| "Excluded" Forest Types | 100 | 1,500 | 150,000 |
| Polygon Description | NA | 1,500 | NA |
| Incremental Provincial Inventory Ground Samples | | | |
| Sample Cluster (upgrade to full VRI) | 20* | 1,000 | 20,000 |
| Sample Cluster (tree only) | 35* | 0 | 0 |
| Provincial Inventory (Remaining) | | | |
| Sample Cluster (VRI) | 60 | 2,500 | 150,000 |
| Sample Cluster (tree only) | 20 | 1,500 | 30,000 |
| Net Volume Adjustment Factor - Tree | 75 | 500 | 37,500 |
| Within Polygon Variation | 30 | 1,500 | 45,000 |
| Total | | | 732,500 |

*Tree information component to be captured as part of the Management Inventory sample

The total cost could be higher or lower if the assumptions stated above are not valid. For example, an increase in the CV or a reduction in the desired precision level will result in an increase in the number of samples required to achieve the objectives. The relationship between the sampling error and sample size is illustrated in the contractor report (Appendix A).

Depending on the implementation strategy, the savings will vary. The savings realized reflect the comparative overlaps of the Management Inventories. The numbers in Table 6 reflect one possible implementation scenario. Costs will change depending on the actual implementation scenario chosen.

## 4.3 Monitoring

The Ministry of Forests, Resources Inventory Branch is responsible for monitoring this Inventory Plan.

## 5. APPROVAL/SIGNING

I have read and concur with the Kootenay Lake Forest District Inventory Plan, July 2, 1998. It is understood that this is an agreement-in-principle and does not commit the signatories to completing the inventory activities outlined within the plan. Modifications to this plan or more detailed plans need to be reviewed and approved by the signatories and then appended to this plan.

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District Manager
Kootenay Lake Forest District

_____

Regional Manager
Nelson Forest Region

_____

Director
Resources Inventory Branch

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Ministry of Environment, Lands and Parks

_____

Kootenay Lake Forest Association

# Appendix A

## Kootenay Lake Forest District
## Vegetation Resources Inventory
## Ground Sampling Plan

# Appendix B

## Polygon Selection